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# 7. STATUS REPORT ON "STUDIES ON THE RADIOACTIVE DATING OF THE LUNAR SURFACE "

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by

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The remaining part of the grant is being used to complete the theoretical studies on methods of dating and other applications of rare gas measurements to lunar surface material. In particular, the nuclear transformations induced by the impacting cosmic ray particles and their secondaries have been studied and relative and absolute production rates of rare gas isotopes have been evaluated.

We have found (1) in stone meteorites a correlation between the ratios $He^3/Ne^{21}$ and $Ne^{22}/Ne^{21}$ produced by cosmic radiation. It has been shown that this correlation is due to a depth effect in the meteorite and, thus, in lunar surface material the measurement of the three isotopes mentioned above will give the average depth at which a lunar sample has been irradiated during its history. This opens a possibility to study erosion processes and accumulation rates at the lunar surface.

We have recently shown (2) that there exists a $Kr^{80}$ excess in some stone meteorites which is due to the absorption of slow neutrons in $Br^{79}$. Quantitative calculations have established that these neutrons are produced in spallation processes induced by cosmic radiation in the meteorite. The neutrons are slowed down within the meteorite before a fraction of them is absorbed in the resonances of $Br^{79}$ in the 30 eV - 300 eV energy interval. Thus, it is evident that this $Kr^{80}$ excess depends strongly on the size of the meteorite. The $Kr^{80}$ anomaly again can be

searched for in lunar surface material and, if found, will afford a very sensitive depth indicator. We have estimated neutron production rates from cosmic ray fluxes at the lunar surface and have calculated their slowing down densities. It has been shown that large $Kr^{80}$ effects can be expected in the surface material of the moon if the bromine contents are comparable to those in meteorites and if the surface of the moon does not contain excessive amounts of primordial krypton. All these calculations, which are based on our experimental work in meteorites, are performed in preparation for the interpretation of future rare gas isotopic analyses of lunar samples.

(1) P. Eberhardt, O. Eugster, J. Geiss and K. Marti;
"Rare gas measurements in 30 stone meteorites";
Z. Naturforschg. 21a, 414-426, 1966.

(2) K. Marti, P. Eberhardt and J. Geiss;
"Spallation, fission and neutron capture anomalies in meteoritic krypton and xenon";
Z. Naturforschg. 21a, 398-413, 1966.